EPISODE 60 OF "ARMED WITH SCIENCE: RESEARCH APPLICATIONS FOR THE MODERN MILITARY," A DEPARTMENT OF DEFENSE WEBCAST HOST: BOB FRIEDMAN GUEST: MASTER SERGEANT KARI HUBLER, USMC DATE: WEDNESDAY, MARCH 24, 2010

NARRATOR: "Armed with Science, Research and Applications for the Modern Military" is a weekly webcast that discusses cutting-edge science and technology and how they apply to military operations. Each week, we will interview scientists, administrators, and operators to educate and inform our listeners about the importance of science and technology to the modern military.

MR. FRIEDMAN: Good afternoon. Welcome to episode 60 of "Armed with Science, Research and Applications for the Modern Military." I'm Bob Friedman. I'm standing in today for your regular host, Dr. John Ohab. And our guest today is Master Sergeant Kari Hubler of the United States Marine Corps. Master Sergeant Hubler has been an enlisted specialist in the field of meteorology and oceanography for the last 17 years.

While most of her career has been spent in operational forecasting, Master Sergeant Hubler currently serves as the curriculum developer and a trainer at the Naval Meteorology and Oceanography Professional Development Center in Gulfport, Mississippi. She's also the Marine Corps liaison to the Naval Meteorology and Oceanography Command for Training and Education.

Master Sergeant Hubler, thank you for being with us today.

SGT. KARI HUBLER: Thank you for allowing me to join you.

MR. FRIEDMAN: Now, I've been told that in the Marine Corps it's a tradition to call the master sergeant Top. May I call you that?

SGT. HUBLER: Absolutely.

MR. FRIEDMAN: Thank you, Top. And also I'd like to set things. We've discussed that we would try to avoid military acronyms and technical jargon, but meteorology and oceanography is a mouthful and I understand that it's common to abbreviate that to METOC, the MET for meteorology and the OC for oceanography. So feel free to use METOC if that makes it easier for you during this discussion.

SGT. HUBLER: Sure, absolutely.

MR. FRIEDMAN: Okay, thanks. Now, you are a METOC specialist for the Marine Corps. Why does the Corps have weather specialists and how are they different from TV weather forecasters?

SGT. HUBLER: That's actually a great question and it's one I get a lot. Actually it's "hey, you do the TV on stuff or are you on TV and stuff?" And it always gives me a laugh because when people think of weather forecasters, they think of the guy on TV. But the Marine Corps, as well as the other services, has operational weather forecasters and what we do is provide our weather forecast information in support of military operations.

So we know that the weather affects all types of daily activities and that can be extended to military operations and capabilities. Specifically environmental parameters ultimately affect any given mission or capability. And we also provide climatological information to help in the mission planning process well in advance of missions that would be conducted in the future. So for these missions that are conducted in the future, we provide tactical environmental information to those arms and conducting commanders to help make those tactical decisions actually during operations. And we do all this in the Marine Corps with -- I think we're a staff just less than 300 people at this point, marines.

MR. FRIEDMAN: Well, can you give us some examples? So when you talk about Marine Corps missions, what type of missions would you be looking at and what type of environmental parameters would you be forecasting for? SGT. HUBLER: That's a good question. Hopefully everybody knows that the Marine Corps supports -- we do land, air, and sea. So the first part of that would be the air and the requirement for Marine Corps weather forecasters came in right after World War I, when the Marine Corps really began to concentrate in aviation operation. So we do aviation weather forecasting, forecasting upper atmospheric parameters such as wind temperature, moisture, other different types of things that have a direct effect on the safety of flight for aviation operations.

MR. FRIEDMAN: Yes, that makes sense.

SGT. HUBLER: Yes. We also do provide forecast for ground operations, but we need to be able to forecast for the full range of military operations. So for example, taking it to the sea side of the house, we frequently conduct amphibious beach landings. So some of the different environmental conditions that we look to not only assess and analyze, the forecasts as well are within a surf zone. So your current speed, the direction of your current beach low tide, things of that nature. At the same tine, for both types of operations, air and sea, we also provide astronomical information to support the mission planners and that thing or parameters such as sunlight, sunset, twilight, nautical twilight, civil twilight, and the amount of -- lunar illumination on a

date -- excuse me. So any element of the physical environment is going to be operationally significant, depending upon the operation at hand.

We're also very interested in how atmospheric conditions affect electro-optical sensors such as night vision goggles as operations are conducted during night time.

Going back to the sea, once we've kind of already landed our troops on the beach, we're going to want to move inward. So for example, on moist tropical climate, we're concerned about the rates and duration of precipitation that occurs, which can affect troop maneuverability inlands. And we're also concerned with the ability of the soil to absorb the precipitation that does fall, which definitely affects the traffic ability of different types of vehicle types.

MR. FRIEDMAN: That's more specific than the weekend weather forecast on TV.

SGT. HUBLER: Most definitely. Do you want me to -- (inaudible).

MR. FRIEDMAN: Sure, absolutely.

SGT. HUBLER: So we talk about tropical environments and beach and desert, which is -- desert and mountains actually, which is of high concern right now. We're interested in definitely the extremes and how they affect or limit performance of ground troops specifically. So forecasting sand storms is another challenge that we've had in the past and continue to have within a desert environment. Within mountainous regions, the weather flows through the mountains are definitely difficult to challenge because of the terrain's effect on the weather system at hand. So very, very dynamic situation within the mountain range and again it's a really big challenge for our forecasters out there to forecast mountain weather.

Another aspect of it is we also have moved into the river environment, where we move troops inland or further upstream, if you want to call it, via the rivers.

So we're definitely interested in riverine analysis and forecasting, especially as it pertains to trying to predict the future states of the river stages and flood potential for a given river.

Those are just some of the examples. We do consider our mission range from the bottom of the ocean to the sun. So we're expected to be subject matter experts within the realm of geoscience. And what I mean by geoscience is we bring in oceanography, hydrography, geology, physical geography, hydrology, meteorology in a space environment, which is a good capture from the bottom of the ocean to the sun.

Our core skill is definitely meteorology and forecasting the atmosphere, but we definitely need that general understanding of the rest of those geosciences that I've just mentioned to analyze and provide

those predictive assessments to support the full range of military operations.

MR. FRIEDMAN: Well, these are certainly things I think most people don't think about. When you think about Marine Corps operations, you think mostly about the military aspect, but certainly from your description, the environment can have a lot of impact on how well the marines are able to conduct their operations and how safely they are.

Well, Top, I understand that this new focus is on river characterization and forecasting the hydrology of river systems. Why -- you've mentioned that a little bit. But can you talk a little bit more about that and what type of challenges are involved in doing riverine forecasting?

SGT. HUBLER: Absolutely. In fact, forecasting the river environment is becoming my new found love because it is such a challenge. But as I mentioned before, as it pertains to riverine operations, we use the river -- we have to cross rivers and we use them to push inland as we're conducting small boat operations. So because we're on the rivers, what we need to do is be able to look at the river and tell -- not only tell what it's currently doing, but what it's going to do in the future. And so when we tie the river environment with the core skills of meteorology, we kind of consider that field to be a subfield of meteorology and a subfield of hydrology, which is termed hydrometeorology. But let me first explain why it's so important. When we're trying to produce a forecast and it's kind of irrelevant on the realm, but we forecast -- we develop our forecast based off of real time data. And based on this data, we can analyze the environment, determine what the physical processes are that are affecting it, and then we take those different variables and forecast the effects over time. It's always a function of time, right?

So on the case -- for the rivers, though, even though you may be forecasting for a specific reach of the river, we need that data over the entire river basin to protect our conditions for a specific point along the river. We start with the detailed weather forecast that includes precipitation rate of fall and duration, and then we need to consider other things like the stream flow of upstream tributaries increase and rivers that ultimately flow into the area that we're concerned with.

We also need to know the different types of soil within the region to determine how precipitation is going to run off or if it's going to run off and not be or infiltrate into the ground.

Another aspect that we need to look at in the river environment is ground cover, vegetation cover and how that's going to affect the ability of the precipitation to infiltrate into the soil and the infiltration of the precipitation or the run off ultimately ends up in the river as it makes its journey back out to the sea, all part of the hydrological cycle.

So a first challenge is to determine how we're going to get this data. And a lot of it right now, as we're conducting operations comes

from institute centers, different reconnaissance missions that are being conducted on the ground, different aircraft flying over the region, and even from space based sensors or remote sensors. So in order -- with specific efforts on forecasting rivers, we have to come up with a strong, sound, sensing strategy that's based on available assets in theater.

Along with obtaining the data, we have to make sure that there's some level of continuity and persistence for the data. Without this continuous collection of the data, you don't get that eyes-on view of what the river does in response to certain meteorological conditions. And because we can't do that, it'll only allow us to be able to produce those generalized river assessments and forecasts. And I can give you one example of that. If you are forecasting for a specific reach on a river and you ultimately determine that the river's going to rise, let's say, 10 feet, if you don't have sensors there on the ground or that eyes-on view, you may be able to accurately predict what the river's going to do or that the river's going to rise 10 feet, but you have no idea how once that river reaches flood stage, what is going to do to the terrain. So you really have to become intimate with your river in order to accurately produce a forecast and the effects that the river's going to have on the surrounding terrain and troops and missions and capabilities. MR. FRIEDMAN: For our listeners who are just joining us, we are talking today with Master Sergeant Kari Hubler, who works at the Naval Meteorology and Oceanography Professional Development Center. Master Sergeant Hubler is a meteorology and oceanography specialist for the Marine Corps.

So that's pretty amazing. It's surprising how complex forecasting rivers can be. And while I hadn't thought about it before, I can see that that could have a really, strong impact on Marine Corps operations in the river, not just for the troops, but also for small boat operations.

Now, when you are in a combat zone, when the marines are in a combat zone, say in Afghanistan or Iraq, how do you get the data you need to develop forecasts? You said that all your forecasts are based on data input. So where do you get most of your data from in a combat zone?

SGT. HUBLER: And that can be really tricky because we are so small in numbers, but we do have certain assets that we bring with us when we deploy. One of those assets is what we call the meteorological mobile facility and it's essentially a mobile unit with a suite of meteorological sensors, upper air, sounding capabilities, meteorological satellites, Doppler radar, and it even has a communication suite. Within this mobile facility, it also has a software that our forecasters need to assist them in analyzing and forecasting the environment, as well as software programs that we call tactical decision aids to help them think how the environment is going to affect specific military operations. And plus, this mobile facility is armored for force protection.

So we have assets in theater that we use to physically sense the environment, but we also conduct what we call reach back operations. So we maintain contact with the Naval Meteorology and Oceanography Command and Warfare Support Center, which helps to provide us specially tailored

mission support so that we can get an accumulated view of the best environmental picture that's out there and provide that to the combatant commanders.

MR. FRIEDMAN: Yes. Well, okay, so you've got Marine Corps specialists that are providing this type of information to the mission commanders. Where do your specialists get their training?

SGT. HUBLER: Well, right after boot camp, all of our marines attend their first school at Keesler Air Force Base, in Biloxi, Mississippi. And it's a joint school that also has Navy METOC sailors going through it, as well as Air Force enlisted personnel. So a big part of this training is specific to each of the services' needs, but ultimately, all three services are after the same core skill of forecasting the atmosphere. For marines, it's approximately eight months long and it's here where our guys are really trained in the essentials of weather forecasting. So only after eight months do they come out with a sound ability to be able to forecast the atmosphere. It's really quite amazing.

MR. FRIEDMAN: That's eight months of eight-hour days?

SGT. HUBLER: Yes, give or take. You might want to throw a little physical training in there as well.

MR. FRIEDMAN: Yes, yes, wow, that's pretty intensive.

SGT. HUBLER: Well, after they go to Keesler, the marines, in order to take those core skills that have been introduced at Keesler Air Force Base, then they go out to the operational forecast -- forces, excuse me, where they learn to actually apply -- or actually where they apply what they have learned in the school and they begin to master those core skills.

Then, they can come back for a follow on sustainment training in education at the Professional Development Center in Gulfport, Mississippi, where this is also a joint Navy and Marine Corps facility that instructs or provides training and education in the realm of the geosciences that I have mentioned before. And that's currently where I'm at serving as a developer and instructor.

MR. FRIEDMAN: Yes, okay. Yes, very good. So -- all right, so you're developing follow on training. How do the course designers, yourself and whoever else is involved, how do you develop science based educational instruction?

SGT. HUBLER: Well, I have to say we developed that very carefully. We have a tough challenge to teach subjects like hydrodynamics and thermodynamics without mathematics. And I say without the mathematics because most of our young marines, they come into the Marine Corps vice going to college right away. I know that that was exactly what happened in my case. I wasn't ready for college, so I came to the Marine Corps. But -- and in essence, they don't have those very

massive, very perquisites of math skills as it pertains to understanding some of the more advanced science subjects.

So then what we do or one of our main tasks is to bring these very complicated subjects within the science realm down to the lowest common denominator, as I like to call it. And I'm not trying to take away the intelligence for many of our marines, but we're trying to do them justice because they really haven't been exposed to those higher level math skills in many cases. And once you start to get into the realm of science, we all know that there's a lot of equations and formulas and theories out there. So we do a lot of careful study and research, mainly through the use of sciences text books and research papers in an effort to break the complicated subjects down -- (inaudible) -- I like to call it.

MR. FRIEDMAN: So you're basically teaching the practical aspects, rather than the theoretical aspects of geosciences.

SGT. HUBLER: We do a combination of the both because you really need a balance of both of those. You need the theory in order to perform the practical aspects. You have to understand what it is you're doing and why you're doing it in order to do it. But again -- and it's a tough challenge to make that happen. MR. FRIEDMAN: Well, now, you're at the Professional Development Center down in Mississippi. Do you have students coming there for classes or are you developing and instruction is delivered in other ways?

SGT. HUBLER: Well, it all depends on what the requirements for the training and education is. We use actually a variety of methods. So for example, some operator training, like on computer systems or software applications is normally best suited for resident classroom environment. And what we mean is the students actually sit in class, in front of a computer with an instructor. Although we can -- with advances in technology -- take that same environment and offer it via distance learning.

We also utilize and develop things like correspondence manuals or text books, web based training, computer based training tutorials, and have even recently moved into the realm of instructor led long distance learning through the use of the Marine Corps College's continuing education. So there's a variety of solutions that we can use and employ depending upon the difficulty of the training requirement and the length of the training that's required.

MR. FRIEDMAN: I see. Well, that sounds like quite a challenge. How have you gained expertise in developing these courses of instruction? I understand that you have a lot of experience yourself as a METOC professional, but how have you learned how to develop new courses or instruction?

SGT. HUBLER: That's a good question too, because with the advances in science and the advances in technology, my knowledge and skills are constantly developing and evolving over time. I believe knowledge is power, so there's always a learning feed in there to learn

more and take that down to the marines. But right now, I'm pursuing my bachelor's in geosciences and professional meteorology and then I'll move on to pursue a master's in education. So my skills are being developed heavily on the education side through use of college basically. But it's kind of funny because the courses that I've taken are pretty much based upon what I need to know in order to develop the training programs for the marines right now. So it does take time -- or it does take a lot of time to train a trainer, especially within such technical field that encompasses so many different elements of the sciences.

MR. FRIEDMAN: Yes, I understand. Top, would you describe your career and tell us how you arrived to this -- your current position?

SGT. HUBLER: Sure, absolutely. Well, I came into the Marine Corps immediately after high school, in June of 1993. And I was pretty young, so I actually graduate boot camp on my 18th birthday. And then from there, I went down and attended initial training at Keesler Air Force Base. And at that time, we actually had two schools. So I first learned how to be a weather observer and that's where you go outside and you actually observe what the clouds are doing, tell what type of precipitation is falling, how fast is falling, where the thunderstorms are at, direction of the movement, and stuff like that. And I did that in my first year, while I was in Okinawa, Japan. And then I came back stateside to Marine Corps Air Station Cherry Point -- that's in North Carolina -- where I started -- I was still considered a weather observer, but I started my training to become a forecaster. And once I was a good, solid assistant forecaster, they sent me back down to Keesler for the second school, which is the forecasting piece of that. And I did all of this within approximately three and a half years of the first time -- before I reenlisted.

My first duty station as a true operational weather forecaster was in 1997, at Marine Corps Air Station Beaufort, South Carolina, where I spent four years there before I transferred to Marine Force Air Facility Quantico, in Virginia, where I spent approximately another three and a half years supporting HMX-1, which is the presidential -- (inaudible).

MR. FRIEDMAN: Oh, well.

SGT. HUBLER: Oh, yes. So the last six months I was on Quantico, they moved me over to Marine Corps Training and Education Command as the representative for the Marine Corps METOC community. And what that really does is it oversees our formal school, specifically the one -- (inaudible) -- Air Force Base and identified and validated training requirements. And from there, I moved down to Gulfport, Mississippi to the Professional Development Center, where I've been for all the most five years now. And it's here where we actually develop and instruct the follow on sustainment training and education requirements.

So 17 years that is coming on pretty quick and it's definitely been a long learning process, but we are definitely paving the way for future marines.

We've developed three new courses within the past several years, the first of them being a course called, "Applied Environmental Sciences Course." And this course contains the different fields of geoscience that I mentioned earlier, seven different chapters, seven different sciences in an act to introduce our marines to those required geosciences beyond meteorology.

We also developed a course called "Meteorological and Oceanographic Impact Analyst Course." And it's in this course where we take the information that was presented, the geoscience information, the science information, teach the students what the Marine Corps is all about, organization, structure, mission planning processes, and then taking that one step further to explain to them or teach them how the environment impacts a given Marine Corps operation or capability platform, center, sub center, we take it down to really the lowest common denominator as it pertains to environmental impact. And the third course we've just launched was "The Riverine Analysis and Forecasting Course," where they get introduced to the general riverine environment. We teach them how to go out there and physically sense the riverine environment, how to come back, analyze that information, and then how to produce a forecast, given the information that they've collected or obtained.

And we're about to begin one more -- we're on the beginning stages of development for a course called "Meteorological and Oceanographic Geospatial Analyst Course." And we have all this information.

We're going to teach the marines how to geo-rectify the information and produce drawn models and you get to better be able to forecast flood environment and provide those predictive impact assessments.

MR. FRIEDMAN: Can you explain to our listeners what you mean by geo-rectify?

SGT. HUBLER: Sure. Actually geo-rectify is the ability to take information and tie it to a specific point on the Earth surface. And most of us are familiar with it. We've all used in every day life. If you've ever gone to MapQuest or Google Maps, that's what geo-rectification is. You type in a point and you obtain data about it.

So what we're interested in the geospatial analysis is to really bring the environment into that and tie environmental information to a given point on the Earth surface.

MR. FRIEDMAN: Yes. Well, it sounds to me like -- that the Marine Corps offers an opportunity for somebody who is interested in Earth sciences and was also interested in a little adventure. Might not be a bad way to experience both.

SGT. HUBLER: Absolutely.

MR. FRIEDMAN: Now, you, in your current position, you are a training specialist and it sounds like in the billet that you held just prior to that, you were involved also in at least identifying and validating training requirements. Is that what you want to do when you retire, you're looking to pursue an education in the sciences?

SGT. HUBLER: Yes and yes. I actually love my current billet because I get the ability to both kind of work at the higher level headquarters requirements, as well as reach right back down to the ground forces and take their requirements and appropriately develop the training that's out there that we need.

So I would love to stay on doing what I'm doing right now post-retirement, but I definitely plan to continue my own education and go for a master's in teaching geosciences. And I haven't quite started looking into the Ph.D., but that's out there in the future.

MR. FRIEDMAN: We've been speaking today with Master Sergeant Kari Hubler, who is a Marine Corps meteorology and oceanography specialist and currently a curriculum developer, a training developer at the Naval Meteorology and Oceanography Professional Development Center.

Master Sergeant Hubler, thank you so much for being here with us today. It was really an interesting conversation.

SGT. HUBLER: Oh, thank you for having me.

MR. FRIEDMAN: And listeners, thank you for joining us. Again, I'm Bob Friedman. I'm standing in for Dr. John Ohab, who will be back for our next show, I believe. And I always want to remind you, as John always says, you have been scienced.

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